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Indian Standard

METHODS FOR SAMPLING OF METAL CONTAINERS

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4 *September* 1966

Indian Standard
METHODS FOR
SAMPLING OF METAL CONTAINERS

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Indian Standard

METHODS FOR SAMPLING OF METAL CONTAINERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 July 1966, after the draft finalized by the Metal Containers Sectional Committee had been approved by the Chemical Division Council.

0.2 Evaluation of quality of a lot with a view to determining its acceptability (or otherwise) is an important problem in any transaction of metal containers. The two alternatives for this purpose are 100 percent inspection and sampling inspection. The former is an uneconomical method, especially in the case of large lots; in the case of tests of destructive nature, it is not to be conceived of at all. On the other hand, the merit of sampling consists in the fact that the inspection of a sample of relatively smaller size taken from a lot will make valid inferences about the lots with considerable economy and accuracy.

0.3 This standard prescribes the sampling details for a number of characteristics and tests, which should adequately cover the checking schedules of most of the consumers. The acceptable quality levels for the various characteristics and tests have been based on the actual data collected from leading manufacturers and consumers in the country. Wherever possible, double or multiple sampling procedures have been recommended so as to reduce the average amount of inspection in the long run.

0.4 This standard contains clauses **3.2**, **3.4**, **4.2.1** and **4.3.1.2** which call for agreement between the purchaser and the supplier.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the methods for sampling and the criteria for ascertaining the conformity of metal containers. Besides, it provides for changeover to tightened and reduced inspections. Broad outlines of controls to be exercised during the manufacture, for ensuring the requisite quality, have also been indicated.

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*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Item — The metal container on which inspection and testing will be performed.

2.2 Lot — A collection of items of the same type and size manufactured under relatively similar conditions of production.

NOTE — Whereas it is not possible to give exact instructions for the formation of lots that will cover all cases, one or more of the following considerations may be helpful in determining the similarity of the conditions of production:

a) Items from a single batch of raw material or from component parts obtained from a single source,

b) Items manufactured by a single production method,

c) Items from a single production line,

d) Items manufactured during a single production shift, and

e) Items produced from one setting of the machines.

2.3 Sample — A collection of items selected for inspection from a lot to reach the decision regarding the acceptance or rejection of the lot.

2.4 Defect — Failure to meet the requirement imposed on an item with respect to a single characteristic:

2.5 Defective — *An item having one or more defects.*

2.6 Percent Defective — 100 times the ratio of the number of defectives to the total number of items.

2.7 Acceptable Quality Level (AQL) — The maximum percent defective that, for the purpose of sampling metal containers, may be considered as a satisfactory process average (*see* Note).

NOTE — When the purchaser designates some specific value of AQL, he indicates to the supplier that his (the purchaser's) acceptance sampling plan will accept the great majority of the lots submitted by the manufacturer, provided the process average level of percent defective in these lots is not greater than the designated value of AQL. Thus, AQL is the designated value of percent defective indicated by the purchaser which will be accepted most of the times (approximately 89 to 99 percent).

2.8 Process Average — The average percent defectives of the items submitted by the producer for original inspection (original inspection is the first inspection for particular quantity of items as distinguished from the inspection of items which have been re-submitted after prior rejections).

NOTE — It is recommended that the process average be estimated from the results for not less than 10 lots. Its value shall be calculated by taking 100 times the ratio of the total number of defectives in the first sample and the total number of items in the first sample of each of the lots.

2.9 Acceptance Number (*a*) — The maximum allowable number of defectives in the sample(s) for acceptance of the lot.

2.10 Rejection Number (*r*) — The minimum number of defectives in the sample(s) for the rejection of the lot.

2.11 Average — The sum of the observations divided by the number of observations.

2.12 Range — The difference between the maximum and the minimum observations.

2.13 Normal Inspection — Inspection that is in force for a particular item and for the supplier initially.

2.14 Tightened Inspection — Inspection with the same sample size or sequence of sample sizes as in the normal inspection, but with lower acceptance and rejection numbers.

2.15 Reduced Inspection — Inspection with the same AQL in the normal inspection, but requiring a smaller amount of inspection.

2.16 Supplier — The party supplying the item. The supplier may or may not be the actual manufacturer of the item.

2.17 Purchaser — The party purchasing the item. The term 'purchaser' will also cover a person or persons expressly authorized in writing by the purchaser to act on his behalf for inspection of the item.

3. PROCESS INSPECTION

3.1 The object of inspection of metal containers by the purchaser is to ensure their conformity to the specification requirements whereas inspection done by the manufacturer during production is to ensure uniformity and reduce quality fluctuations to the minimum. For process control, the manufacturer shall take representative samples of the product at regular intervals to control the quality fluctuations. For items of the same lot, the inspection levels given below are recommended for routine control over the manufacturing process:

Characteristics / Tests	*Frequency of Inspection / Tests*
Visual (such as appearance, workmanship and finish)	50 containers for every hour's production
Dimensions (such as base diameter and height)	Five after the setting of machines and, thereafter, one for every hour's production
Formation of joints (such as welding and seaming) examined by cutting and opening the joint	For each machine, two after setting the machine and, thereafter, one for every hour
Air pressure test	All or 50 every hour, as applicable
Hydraulic pressure test and drop test	One for every 1 000 containers or part thereof
Handle Pull test	One for every 1 000 containers or part thereof

3.2 The basic raw material used in the manufacture of metal containers shall conform to the requirements laid down in the relevant Indian Standard specifications. Obtaining necessary test certificate with each consignment of the material and performing random check tests independently, if desired by the purchaser, may be helpful in ensuring the quality of the raw material. For additional assurance for gauge, however, at least 10 sheets from each consignment shall be inspected. These sheets shall be selected at random and, for this purpose, a suitable number of bundles (not less than 20 percent of the total number of bundles in the cosignment, subject to a minimum of 2) shall be first chosen and, from each of the bundles so chosen, an approximately equal number of sheets shall be picked up so as to obtain a total of 10 sheets.

3.3 For effective process control, the use of statistical quality control techniques is recommended. Helpful guidance may be obtained in this respect from IS : 397-1952*.

3.3.1 The inspection data or the results of tests done at the place of manufacture may be made available along with the item supplied to enable the purchaser to judge the acceptability of the lot.

3.4 When it is not possible to make such information available to the purchaser or when the purchaser so desires, the procedure laid down in **4** shall be followed for judging the conformity of the lot of the metal containers to the requirements of the relevant material specifications.

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*Method for statistical quality control during production by the use of control chart.

4. LOT INSPECTION

4.1 Scale of Sampling

4.1.1 The sample containers shall be selected and examined separately for each lot for ascertaining their conformity to the requirements of the relevant specification.

4.1.2 The number of metal containers to be selected from a lot shall depend upon the size of the lot and shall be in accordance with col 1 and 3 of Table 1 for normal inspection.

4.2 Method for Selecting Metal Containers

4.2.1 The containers to be selected from the lot shall be chosen at random. In order to ensure the randomness of selection, a random number table as agreed to between the purchaser and the supplier shall be followed.

4.2.2 In case a random number table is not available, the containers may be selected from the lot in the following manner:

> Starting from any container in a lot, the containers shall be counted as 1, 2,..............r and so on in one order. Every rth container thus counted shall be withdrawn to constitute the sample, where r is the integral part of N/n (N and n being the lot size and the corresponding sample size respectively). This procedure shall be stopped as soon as the required number of containers is obtained.

4.2.2.1 For example, if a total sample of 250 containers is to be selected from a lot of 21 050 containers for the examination of visual characteristics (Table 1), then the value of r is obtained as the integral part of 21 050/250 (= 84·2), which is 84. Starting from any container, the containers shall be counted in one order and every 84th container shall be withdrawn.

4.2.3 When the containers in a lot are packed in different boxes, a suitable number of boxes (not less than 10 percent of the total number in the lot, subject to a minimum of 2) shall first be chosen at random. From each of the boxes so chosen, an approximately equal number of containers shall be picked up from its different parts or layers to obtain the required number of containers.

4.2.3.1 For example, if a lot consists of 1 200 containers packed in 100 boxes, each containing a dozen, not less than 10 boxes shall be chosen at random. If it is decided to open 10 boxes, 10 containers shall be picked up from different parts of each of the 10 boxes so as to give a total of 100 containers for the examination of visual characteristics as specified in Table 1. In case the number of containers obtained in the sample is less than the corresponding sample size in Table 1, additional containers may be selected for test from the other boxes.

TABLE 1 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES IN CASE OF NORMAL INSPECTION, FOR VISUAL CHARACTERISTICS AND AIR PRESSURE TEST

(*Clauses* 4.1.2, 4.2.2.1, 4.2.3.1, 4.3.1, 4.3.1.1 *and* 4.4.2.1)

No. of Items in the Lot	Sample	Sample Size	Cumulative Sample Size	Visual Characteristics		Air Pressure Test								
						Scale A		Scale B		Scale C				
										Sample	Sample size	Cumulative sample size		
				a	*r*	*a*	*r*	*a*	*r*				*a*	*r*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Up to 3 000	1st	50	50	3	7	2	5	0	3					
	2nd	50	100	8	9	6	7	3	4	1st	125	125	0	3
3 001 to 10 000	1st	80	80	5	9	3	7	1	4	2nd	125	250	3	4
	2nd	80	160	12	13	8	9	4	5					
10 001 to 35 000	1st	125	125	7	11	5	9	2	5					
	2nd	125	250	18	19	12	13	6	7	1st	200	200	1	4
35 001 and above	1st	200	200	11	16	7	11	3	7	2nd	200	400	4	5
	2nd	200	400	26	27	18	19	8	9					

Note — Scale A is recommended for use in the case of containers for high viscosity liquids and Scale B for those for low viscosity liquids. For the purpose of this standard, liquids having viscosity greater than that of water shall be considered as high viscosity liquids. Scale C is recommended for containers used for storing highly volatile liquids with flash point below 24·4°C.

4.3 Criteria for Conformity

4.3.1 *Visual Characteristics and Air Pressure Test* — All the containers drawn according to Table 1 shall be first examined for visual characteristics like appearance, workmanship and finish. Any container failing in one or more of the visual characteristics shall be considered as defective. If in the first sample the number of defective containers is less than or equal to the corresponding acceptance number, the lot shall be declared as conforming to the requirements of the visual characteristics. If the number of defectives is greater than or equal to the rejection number, the lot shall be deemed as not meeting the requirements for the visual characteristics. If the number of defectives is greater than the acceptance number but less than the rejection number, a second sample of the size equal to that of the first shall be taken to determine the conformity or otherwise of the lot. The number of defectives found in the first and second samples shall be combined and, if the combined number of defectives is less than or equal to the corresponding acceptance number, the lot shall be declared as conforming to the requirements of visual characteristics, otherwise not.

4.3.1.1 The sample containers, which have been used for ascertaining the conformity of the lot to the requirements of visual characteristics, shall then be used for ascertaining the conformity to air pressure test in the same manner as prescribed in **4.3.1** (using the corresponding acceptance and rejection numbers as given in Table 1).

NOTE — In the case of containers used for storing highly volatile liquids, additional items may have to be chosen to make up the sample for air pressure test (Scale C in Table 1).

4.3.1.2 In the case of those lots, which have been found unsatisfactory according to **4.3.1** or **4.3.1.1**, all the items may, depending upon the agreement between the purchaser and the supplier, be inspected for visual characteristics and air pressure test and the defective ones removed.

4.3.2 *Dimensional Characteristics* — From the sample of metal containers drawn for an examination of visual characteristics and air pressure test, 10 containers shall be checked for dimensional requirements like diameter, height and countersink, as specified in the relevant standard. From the measurements obtained for each of such characteristics, the average (**2.11**) and the range (**2.12**) shall be calculated. In case the value of the expression 'average ± 0·5 range' lies within the relevant specification requirements, the lot shall be considered as satisfactory, otherwise not.

4.3.3 *Capacity* — Five containers shall be selected from those already found satisfactory for visual, air pressure and dimensional requirements and tested for capacity with the closures on. The average (**2.11**) and the range (**2.12**) of the test results shall then be calculated. In case the value of the expression 'average ± 0·6 range' lies within the relevant specification requirements, the lot shall be deemed as having satisfied the capacity requirements, otherwise not.

NOTE — Since the actual capacity of the metal container has been found to be highly correlated with that calculated from base dimension and height, a smaller sample has been recommended for capacity verification as compared to dimensional checking.

4.3.4 *Hydraulic Pressure, Handle Pull and Drop Tests* — The lot, which has been found satisfactory in respect of capacity requirements also, shall then be tested for hydraulic pressure, handle pull and drop tests. The containers for each of these purposes, shall be taken at random from those already drawn in accordance with Table 2. If the number of containers failing to satisfy the requirements for these characteristics is greater than or equal to the corresponding rejection number given in col 5 and 10 of Table 2, the lot shall be deemed as not meeting the requirements in respect of these characteristics. If, however, the number of defectives is less than the corresponding rejection number, a second sample of the size equal to that of the first shall be taken to determine the conformity of the lot. It may be noted that the lot will not be accepted in any case on the basis of the first sample. If the combined number of defectives in the two samples is less than or equal to the corresponding acceptance number, the lot shall be declared as conforming to the requirements of these characteristics. In case the combined number of defectives is greater than the corresponding rejection number, the lot shall be deemed as not conforming to these requirements. If, however, the number of defectives lies in between the acceptance and rejection numbers, a third sample of the size the first and the second shall be taken and inspected for these requirements and the inference drawn accordingly.

TABLE 2 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES FOR HYDRAULIC PRESSURE, HANDLE PULL AND DROP TESTS IN CASE OF NORMAL INSPECTION

HYDRAULIC PRESSURE AND HANDLE PULL TESTS					DROP TESTS				
Sample	Sample Size	Cumulative Sample Size	*a*	*r*	Sample	Sample Size	Cumulative Sample Size	*a*	*r*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1st	3	3	*	3	1st	2	2	*	2
2nd	3	6	1	3	2nd	2	4	1	3
3rd	3	9	2	3	3rd	2	6	2	3

*Acceptance not permitted at this sample size.

4.4 Reduced and Tightened Inspection

4.4.1 In case the quality of the submitted lots varies considerably, it would be desirable to make appropriate changes in the sampling plan. If the quality of the lots as submitted by the supplier is consistently good, it may be desirable to relax the inspection with a view to effecting economies in inspection. On the other hand, if the quality of the lots submitted by the supplier is consistently bad, it may be desirable to tighten the inspection.

4.4.1.1 Relaxation of inspection has been achieved be reducing the sample size recommended for normal inspection and retaining approximately the same acceptable quality levels (as far as possible) as given in Tables 1 and 2.

4.4.1.2 Tightening of inspection has been achieved by retaining the same sample size as in the normal inspection, but reducing the acceptable quality levels by way of reduction in the acceptance and rejection number, wherever possible.

4.4.2 *Reduced Inspection*

4.4.2.1 *Air pressure test and visual characteristics* — If none of the eight consecutive lots has been rejected while on normal inspection, change over to reduced inspection as given in Table 3. Normal inspection shall be reinstated if a lot is rejected and is preceded by less than 8 lots accepted on reduced inspection.

4.4.2.2 *Hydraulic pressure, handle pull and drop tests* — If none of the eight consecutive lots has been rejected while on normal inspection, change over to reduced inspection as given below:

a) Only two samples need be tested from a lot and not more than one defective shall be found.

b) Normal inspection shall be reinstated if, on reduced inspection, three defectives are found in the preceding eight consecutive lots.

4.4.3 *Tightened Inspection*

4.4.3.1 *Air pressure test and visual characteristics* — If two of the five consecutive lots have been rejected while on normal inspection, change over to tightened inspection as given in Table 4. Reinstate normal inspection when five successive lots are accepted under tightened inspection.

TABLE 3 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES FOR REDUCED INSPECTION

(*Clause* 4.4.2.1)

No. of Items in the Lot	For Visual Characteristics					For Air Pressure Test								
	Sample	Sample Size	Cumulative Sample Size	*a*	*r*	Scale A		Scale B		Scale C				
						a	*r*	*a*	*r*	Sample	Sample size	Cumulative sample size	*a*	*r*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Up to 3 000	1st	32	32	2	5	1	4	0	2					
	2nd	32	64	6	7	4	5	1	2	1st	80	80	0	2
3 001 to 10 000	1st	50	50	3	7	2	5	0	3	2nd	80	160	1	2
	2nd	50	100	8	9	6	7	3	4					
10 001 to 35 000	1st	80	80	5	9	3	7	1	4					
	2nd	80	160	12	13	8	9	4	5	1st	125	125	0	3
35 001 and above	1st	125	125	7	11	5	9	2	5	2nd	125	150	3	4
	2nd	125	250	18	19	12	13	6	7					

Note — Scale A is recommended for use in the case of containers for high viscosity liquids and Scale B for those for low viscosity liquids. For the purpose of this standard, liquids having viscosity greater than that of water shall be considered as high viscosity liquids. Scale C is recommended for containers used for storing highly volatile liquids with flash point below 24·4°C.

TABLE 4 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES FOR TIGHTENED INSPECTION

(*Clause* 4.4.3.1)

No. of Items in the Lot	Visual Characteristics					Air Pressure Test								
	Sample	Sample Size	Cumulative Sample Size	*a*	*r*	Scale A		Scale B		Scale C				
						a	*r*	*a*	*r*	Sample	Sample size	Cumulative sample size	*a*	*r*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Up to 3 000	1st	50	50	2	5	1	4	0	2	1st	125	125	0	2
	2nd	50	100	6	7	4	5	1	2	2nd	125	250	1	2
3 001 to 10 000	1st	80	80	3	7	2	5	0	3					
	2nd	80	160	8	9	6	7	3	4					
10 001 to 35 000	1st	125	125	5	9	3	7	1	4	1st	200	200	0	3
	2nd	125	250	12	13	8	9	4	5	2nd	200	400	3	4
35 001 and above	1st	200	200	7	11	5	9	2	5					
	2nd	200	400	18	19	12	13	6	7					

Note — Scale A is recommended for use in the case of containers for high viscosity liquids, and Scale B for those for low viscosity liquids. For the purpose of this standard, liquids having viscosity greater than that of water shall be considered as high viscosity liquids. Scale C is recommended for containers used for storing highly volatile liquids with flash point below 24·4°C.

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*Sales Office Calcutta is at 5 Chowringhee Approach, P. O. Princep Street, CALCUTTA	27 68 00
† Sales Office is at Novelty Chambers, Grant Road, BOMBAY	89 65 28
‡ Sales Office is at Unity Building, Narasimharaja Square, BANGALORE	22 39 71

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